Neonicotinoid Proposed Interim Decisions

These efforts reflect collaboration between RD, BEAD, EFED, HED and PRD, and chemical teams for all 4 neonics from each division. The interdivisional team met regularly to discuss assessment progress, methods and make sure that the assessments addressed PRD's needs.

Outline

- Overview
- Risk Management Approach
- Bee Risks and Benefits
- Bee Risk Mitigation
- Other Ecological Risk Mitigation
- Human Health Mitigation
- Other Considerations
- Next Steps

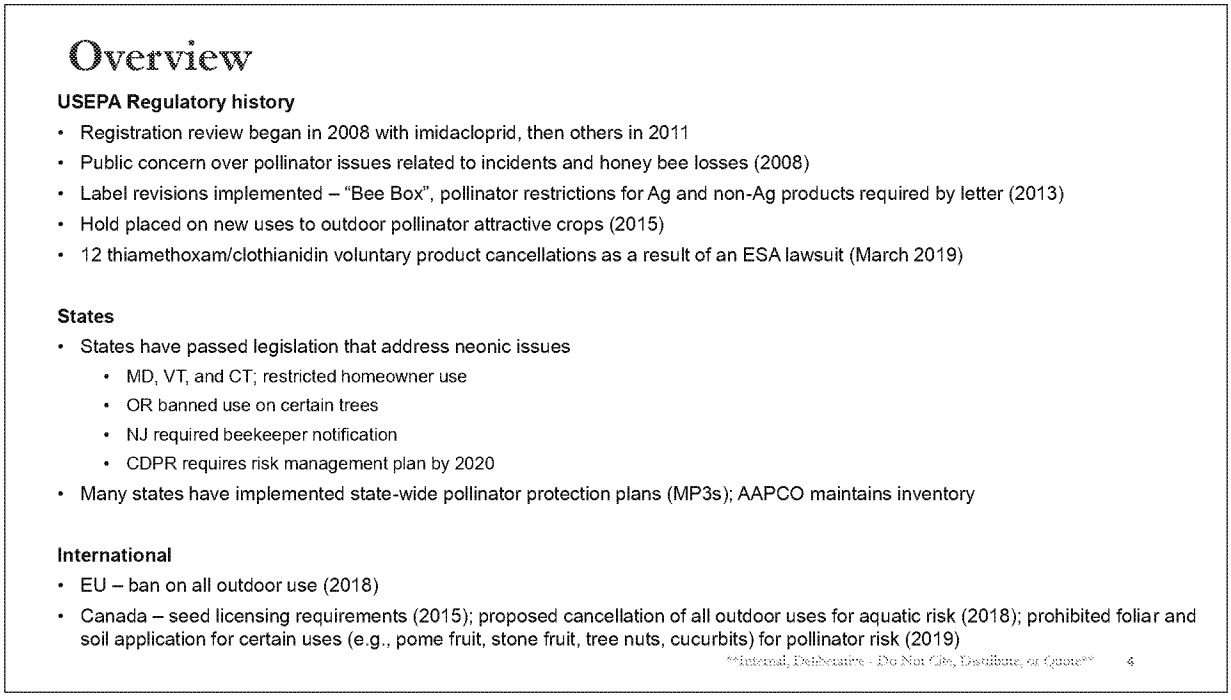
Overview

Nitroguanidine-substituted neonicotinoids (includes: imidacloprid, clothianidin, thiamethoxam, and dinotefuran) are:

- A class of systemic insecticides registered for foliar (ground and air), soil, seed, and tree injection applications to a wide variety of agricultural crops
- Non-agricultural uses include turf, ornamentals, flea treatment for pets, wood preservative, poultry house, and other residential and commercial indoor/outdoor uses
- Most poundage applied as seed treatment for corn and soybean

Chemical	Est. annual usage (lbs/yr)	Major uses (lbs/year)
Clothianidin	1,500,000	**Corn** (seed treatment; 1,400,000)
Imidacloprid	1,120,000	**Soybean** (seed treatment, 430,000) **Cotton, Potato, Wheat** (all app. methods, 100,000 ea.)
Thiamethoxam	919,000	**Corn** (seed treatment; 300,000) **Cotton** (foliar, soil, seed; 160,000) **Soybean** (seed treatment; 300,000)
Dinotefuran	22,500	**Cantaloupes** (5,000) **Rice** (foliar; 4,000)

Big take aways:
Nitroguanidine neonics include imi, clothi, thia, and dino (not acetamiprid).
Used on a variety of ag and non-ag crops
The majority of the use is as a seed treatment for corn and soybean, followed by foliar and soil applications to cotton, potato, and wheat.



Why are we talking about the neonics? Incidents related to honey bee losses, neonics being highlighted in the media, and state and international legislation.

Canada's seed licensing requirements: https://www.ontario.ca/page/neonicotinoid-regulations-seed-vendors

Overall Risk Management Approach

Risk Management Priorities

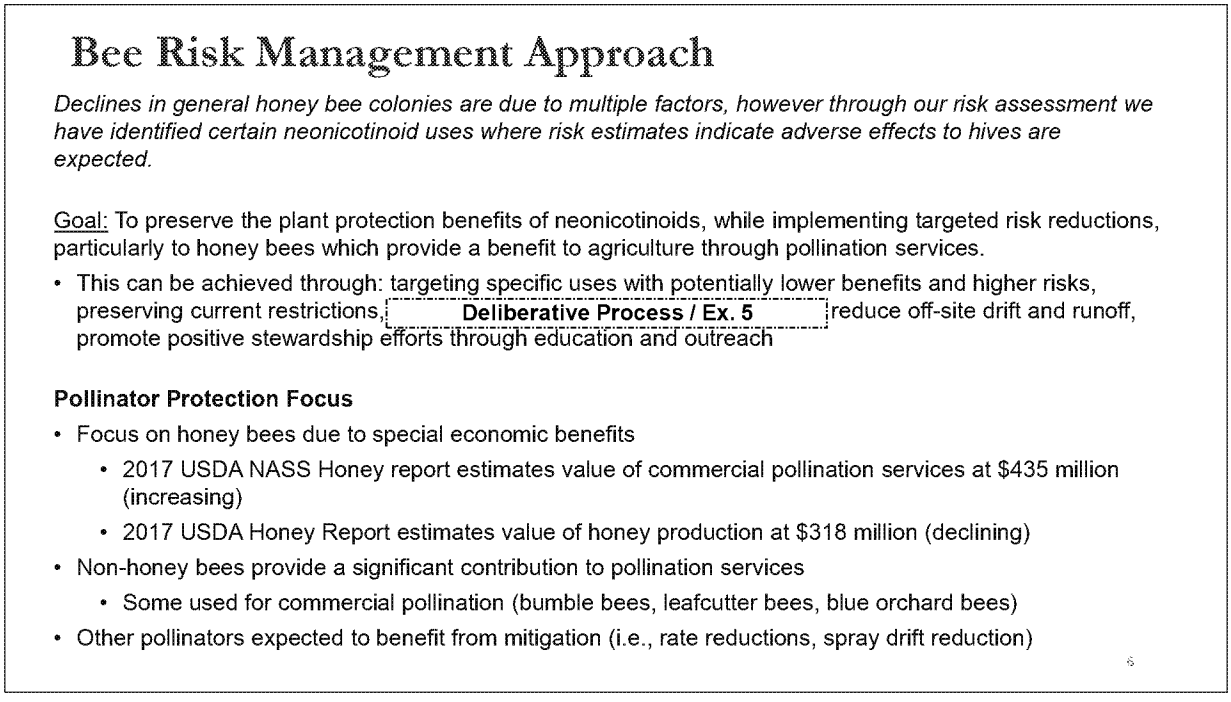
- Human Health Risks of Concern (residential and occupational)
- Ecological Risks of Concern
  - Pollinators (bees) – from multiple use sites
  - Birds and Mammals – from consuming treated seed
  - Aquatic Invertebrates – mainly from foliar application to multiple uses

Early Stakeholder Engagement

- Goals
  - To inform risk assessments and understanding of exposure to bees
  - To better understand benefits of uses preliminarily identified with risks of concern
- Stakeholders: Federal and state partners (USDA, OPMP; SFIREG, AAPCO, and NASDA; IR-4; Growers; Registrants; Other Stakeholders (American Hort, NALP, NPMA)

For our overall risk management approach, these are the areas where the risk assessments indicated mitigation was needed, and that per our regs, for the non FQPA risks, we considered benefits extensively in our risk benefit calculus where appropriate, and this information is woven throughout our discussion on mitigation. Exceedances were identified for human health (residential and occupations), pollinators, birds and mammals, and aquatic invertebrates.

Discussed with registrants potential mitigation options and reach out to stakeholders very early on in the process.



Firstly, our risk management approach acknowledges, as has been the stance from EPA for years, that overall declines in honey bee colonies nationally are likely due to a multitude of factors. We focus on the pesticide aspect here per our statute, but to truly make strides at reducing overall population declines we need to also acknowledge a multitude of factors such as parasites, habitat decline, etc.

Our risk management approach to the neonics is to preserve a key tool for growers while maximizing targeted risk reductions, particularly to honey bees which also provide a benefit to agriculture through pollination services. Honey bees are a piece of it but non honey bees such as bumble bees, leafcutter bees, and blue orchard bees also play a factor. Additionally, it is important to put forth mitigation that also reduces impact to wild native North American species of bees.

But it's important to keep in mind that the protection of honey bee populations also protects agriculture which requires commercial pollination.

We're proposing addressing risk by:
Targeting certain uses with potentially lower benefits and higher risks during the critical pre-bloom exposure period
Preserving the current restrictions for application at-bloom to reduce the (acute risk) immediate impacts of exposure

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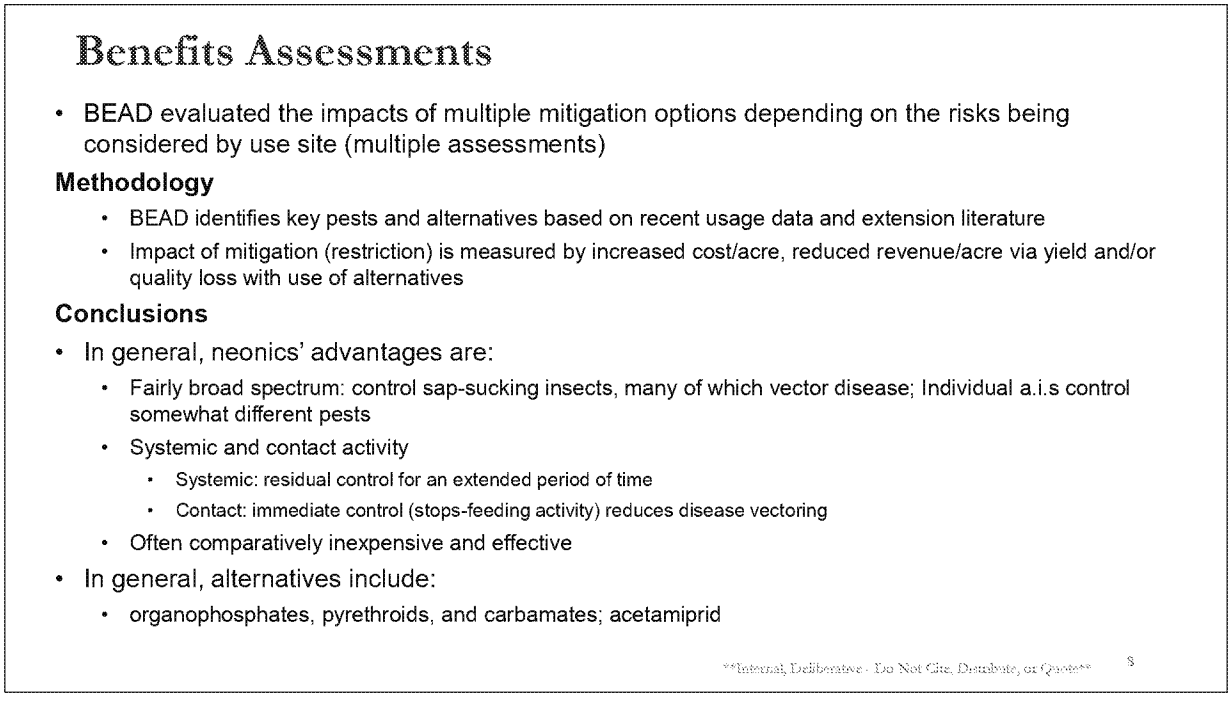
Reducing exposure off-site by reducing drift and runoff
Promoting voluntary stewardship efforts to encourage best practices, education, and outreach to applicators and beekeepers

Ecological Risk - Bees

Lines of evidence considered in making risk call

- Based on crops that are attractive to bees
- Based on agronomic practices (e.g., harvest time relative to bloom)
- Comparison of residues to adverse effects level for hives (residues above NOAEC and LOAEC)
  - Considered duration and frequency of exceedance
  - Considered magnitude of exceedance
    - Ratio of max residue value to NOAEC/LOAEC
    - % of diet from the treated field needed to reach the NOAEC/LOAEC
  - Considered usage and geographic scale/spatial distribution of exposure
- Major Categories of Incidents
  - Bee kills from dust-off from corn seeds treated with clothianidin
  - Bee kills from ornamental tree applications
  - Bee kills from drift of spray application to agricultural fields

Risks of concern result primarily from foliar applications and some soil applications
Risks are estimated to extend >1,000 ft from the edge of the field (foliar spray)



BEAD team worked diligently to provide individual benefits assessments for a multitude of crop groups (i.e.: cucurbits, grapes, seed treatments on small grains, vegetable, and sugarbeet crops, pome fruits, stone fruit, berries, fruiting vegetables, brassica vegetables, leafy green vegetables, tree nuts, root & tuber vegetables, bulb vegetables, herbs, peanut, legume vegetables, and tropical and sub tropical fruit.)

BEAD looked into identifying key pests and potential alternatives based on usage data and extension information, and incorporated the most recent risk management proposals to try and calculate potential impacts of mitigation, measured by increased costs per acre, a reduction in revenue per acre, and/or potential quality loss with use of alternatives.

BEAD identified several key advantages to neonicotinoid use:
It can control a variety of pests including those that vector diseases but each individual a.i. was shown to have certain niches for different pests
Although when we think about neonics we think about the systemicity, its residual control of pests for an extended period of time (why the seed treatment use is so effective), but BEAD also found scenarios where contact control with neonics is also utilized.
Overall, the neonics were found to be comparatively less expensive and effective than some of the alternatives.
Some alternatives included organophosphates, pyrethroids, and carbamates, but also alternative neonics such as acetamiprid.

Potential Benefits by Application Timing Stage

	At-Plant/ Early Season	Pre-Bloom Benefit	At-Bloom Benefit	Post-Bloom Benefit	Important Actives
Berries (indeterminate bloomers)	N/A	Uncertain	**High**		Imidacloprid and Thiamethoxam; some clothi and dino use (target different pests)
Berries (discrete bloom period)	N/A	Uncertain	Low to None	**High**	
Grape	N/A	**High**	**High**	**High**	Imidacloprid
Cucurbit	High	Medium	Low		Imidacloprid, Thiamethoxam, and Dinotefuran
Fruiting Vegetables	High	**High**	**High**		Imidacloprid
Stone Fruit	N/A	Low	Low to None	**High**	Imidacloprid and Thiamethoxam
Pome Fruit	N/A	Medium*	Medium*	**High**	Thiamethoxam and Imidacloprid (target different pests)
Tree Nut	N/A	Low	Low	**High**	Imidacloprid
Cotton	**High**	**High**	Medium		Imidacloprid and Thiamethoxam
Citrus	N/A	**High**	**High**	**High**	Imidacloprid and Thiamethoxam
Ornamentals	**High**	**High**	N/A	**High**	Imidacloprid and Dinotefuran

** Based on additional information received through grower feedback/discussions during PID preparation*
1. Uncertainty surrounding the benefits pre-bloom through post-bloom. Potentially high. Strawberry is an indeterminate bloomer and therefore there is no discrete difference between bloom and post-bloom.

Example of the kinds of benefits assessed – presented here, benefits by application timing stage

Note that cucurbit and cotton are indeterminate bloom – not really a 'post-bloom' period. Also true of strawberry and some of the caneberries (denoted in table by the dots/different background).
Special Pest Issues generally defined as any pest that can potentially cause widespread and catastrophic reductions in yield or value of crops at harvest without full neonicotinoid (need for multiple neonics/multiple application methods) use (nationally or regionally).
Berries = ex. blueberry maggot (crop rejection), whiteflies (disease vector)
Indeterminate bloomers include: strawberries, caneberries, potentially others within the group
Determinate bloomers (discrete bloom period) include: blueberries, cranberries, potentially others within the group
Grape = Sharpshooter
Pome = ex. Pear psylla and plum curculio (thiamethoxam targets; very important for the pre-bloom and bloom time use); imi used to control aphids (full season control; pre-bloom alt is chlorpyrifos)
Cotton = indeterminate bloom; plant/stink bugs are bloom pests, combinations of OPs + pyrethroids are likely alternatives
Citrus = ACP (vectors HLB)
Ornamentals = emerald ash borer ; white flies ;

Summary of Honeybee Risk Conclusions for Foliar Applications

Cell Key:
Red = higher risks
Green = lower risks
Gray = uses not registered

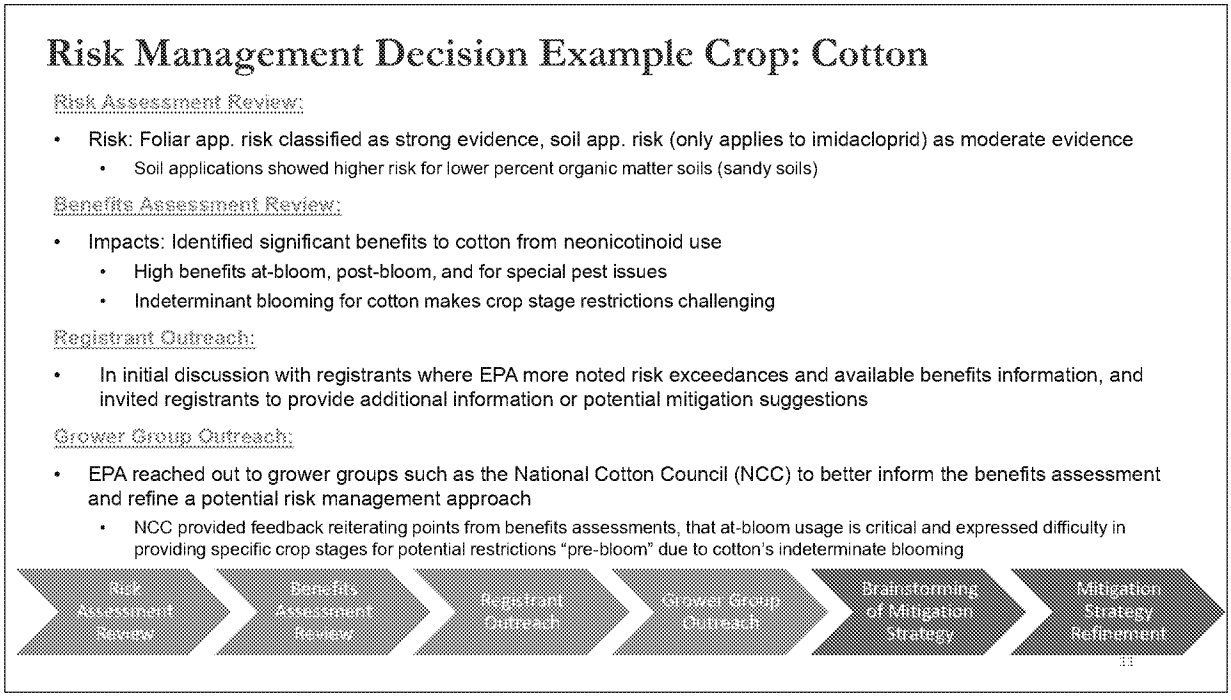
The strength of evidence for each risk call is identified in black text ("strongest" or "weakest").

Strongest evidence of risk for all A.I.s:
- Cotton
- Cucurbits
- Pre-bloom orchard, berries and small fruits
- Fruiting vegetables

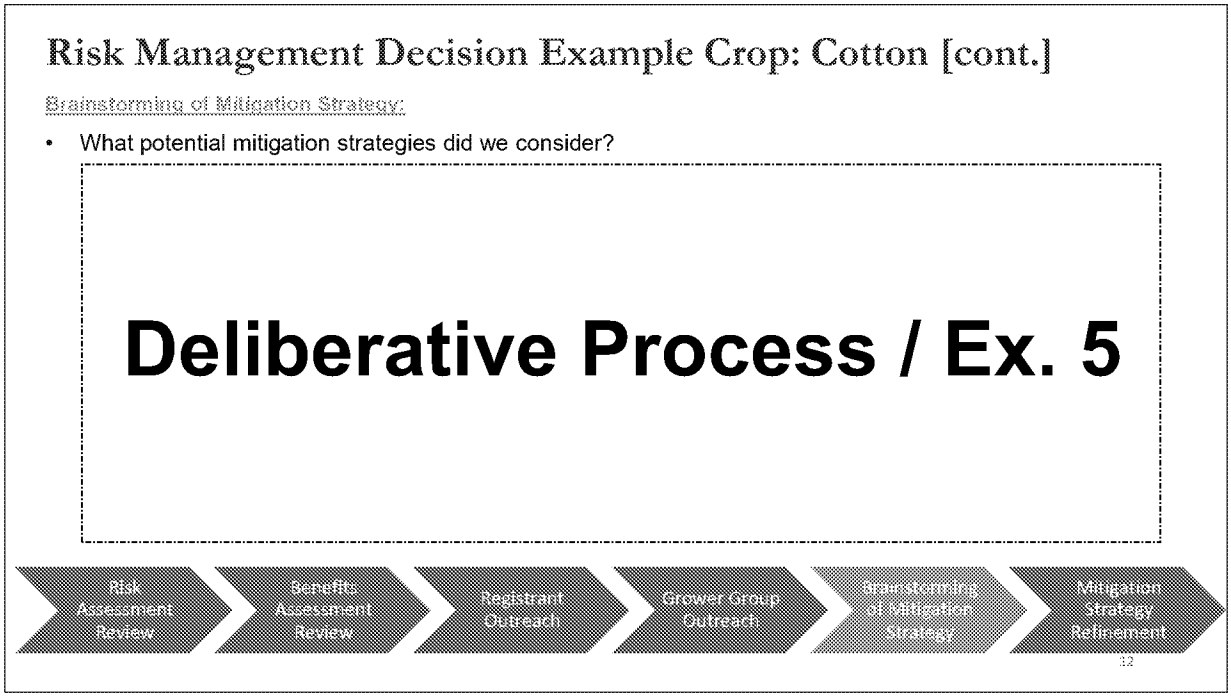
Crop Group or Crop	Imidacloprid		Clothianidin		Thiamethoxam		Dinotefuran	
Cotton	Strongest		Strongest		Strongest		Strongest	
Cucurbit Vegetables			Strongest		Strongest		Strongest	
Citrus Fruits	Pre-Strongest	Post-Weakest			Pre-Strongest	Post-		
Pome Fruits	Pre-	Post-Weakest	Pre-	Post-	Pre-Strongest	Post-		
Stone Fruits	Pre-	Post-Weakest	Pre-	Post-	Pre-Strongest	Post-	Pre-Strongest	Post-
Tree Nuts	Pre-	Post-	Pre-	Post-	Pre-Strongest	Post-		
Tropical Fruits	Pre-Strongest	Post-Weakest	Pre-	Post-	Pre-Strongest	Post-		
Berries/Small Fruits	Pre-Strongest	Post-	Pre-Strongest	Post-	Pre-Strongest	Post-	Pre-Strongest	Post-
Root/Tubers Vegetables*	Weakest		Weakest		Weakest		Weakest	
Fruiting Vegetables*	Strongest				Strongest		Strongest	
Herbs/Spices	Weakest				Weakest			

Example of the way pollinator risk was assessed – presented here, foliar applications for agricultural crops. Red cells are risk, green cells are low risk, and gray cells are not uses not registered for the corresponding AI. This table identifies the strength of evidence for the risk call in black text.

This table summarizes the risk conclusions for foliar applications. Red cells are risk, green cells are low risk, and gray cells are not registered. As with the low risk calls, for orchards and berries and small fruits, risk calls are distinguished for pre-bloom vs. post-bloom applications. Note that most of these calls were yellow in the preliminary assessments due to gaps in the residue database. Bridging really allowed us to make them all green or red. This table also identifies the strength of evidence for the risk call in black text. Cotton, cucurbits, pre-bloom orchard, pre-bloom berries and small fruits, and honey bee attractive fruiting vegetables are strongest evidence of risk for all chemicals.



Corn is used here as an example of the risk management approach used to select the mitigation strategies being presented; this approach was used for each of the crop groups and FIFRA risk categories.



Imidacloprid used as an example only, this analysis was done for all four neonics.

Risk Management Decision Example Crop: Cotton [cont.]

Mitigation Strategy Refinement:

- Rate reduction was determined to be best path forward
- Reduction of maximum annual and maximum single application rates only
  - reduces risk while retaining flexibility for growers
  - addresses neonic systemicity, reducing chronic exposure
- Although acute mitigation (*e.g.*, bee box) was triggered for other crops, was not applicable to non-food crops such as cotton
- Rates: BEAD provided detailed rate information [see table with imidacloprid as an example]. From this, PRD determined that a 25% reduction in the rate from 0.5 to 0.375 lbs a.i./A annually would reduce the overall risk while minimally impacting growers

BEAD Rate Analysis: Cotton

	Imidacloprid
Minimum Label Rate (lb a.i./Acre)	0.062 (F) 0.350 (S)
Maximum Annual Rate (lb a.i./Acre/year)	0.500
Average Application Rate (lb a.i./Acre)	0.103
Application Rate Distribution (% PAT treated at or below rate)	16% ≥ 0.210 8% ≥ 0.280
Average Annual Rate (lb a.i./acre/year)	0.151
Annual Rate Distribution (% PAT treated at or below rate)	13% ≥ 0.300 2% ≥ 0.400

Risk Assessment Review → Benefits Assessment Review → Registrant Outreach → Grower Group Outreach → Brainstorming of Mitigation Strategy → Mitigation strategy Refinement

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Imidacloprid used as an example only, this analysis was done for all four neonics.

Risk Mitigation Summary – Bees (agricultural use), slide 1 of 3

Highest Impact Uses: Uses where neonicotinoids play a critical role in pest management to the extent that certain risk mitigation measures targeted at reducing pollinator exposure would have significant impacts on the use (i.e., alternatives exist but are substantially more expensive) or existing alternatives pose potential increased risks to human health

Mitigation Measures

- Application Rate Reduction (annual) – Cotton, Pome Fruit, Stone Fruit
  - Rate reductions selected to have minimal impact on most applications – goal is to limit flexibility for highest rates that are rarely used
  - Cotton is indeterminate blooming, increasing impact of bloom restriction
  - Also reduces risks to aquatic invertebrates
  - Risk reductions extend off-field

- Pre-bloom Application Interval – Pome Fruit, Stone Fruit, and Tree Nuts (thiamethoxam and dinotefuran only)
  - Majority of benefit occurs post-bloom, other neonicotinoids already prohibit pre-bloom application
  - Use crop stage to designate when applications may no longer occur (i.e., "Do not apply after swollen bud until petal fall")

- No mitigation – Citrus, Grapes
  - Full use of neonicotinoids crucial to crops due to specific pest pressure (e.g., ACP, glassy-winged sharpshooter)

This slide goes over mitigation measure to highest impact uses that play a critical role in pest management but also carried significant risk exceedances to bees.

Risk Mitigation Summary – Bees (agricultural use), slide 2 of 3

Lower Impact Uses: Uses where neonicotinoids are an important tool for certain pests or at certain time periods

Mitigation Measures

- Application Rate Reduction (annual) – Berries (non-grape)
  - Some berries are indeterminate blooming, increasing impact of bloom restriction
- Pre-bloom Application Interval – Fruiting Vegetables, Cucurbits, Tropical and Sub-Tropical Fruit
  - Use crop stage to designate when applications may no longer occur ("Do not apply after appearance of flower bud until petal fall")
  - For Tropical and Sub-Tropical Fruit, would only apply to highest usage crops (e.g., avocado, pomegranate)
    - Note that benefits uncertain due to limited data; Agency will consider public comments on PID
- No mitigation – Root and Tuber, Herbs and Spices, Tropical and Sub-tropical fruits
  - Additional use characterization of acres grown and pollinator attractiveness limit extent of risks of concern

This slide goes over mitigation measure to lower impact uses that play an important role for certain pests or at certain time periods however were not deemed "critical", and for which high exceedances to bees were still noted.

Risk Mitigation Summary – Bees (agricultural use), slide 3 of 3

Mitigation Measures

- For acute risk to bee (direct contact exposure during bloom)

Current Mitigation Measures

- At-bloom application restrictions/statement
  - Applies to all food crops that are pollinator attractive
  - For non-ag crops: do not apply while bees are foraging/plants are flowering etc.
  - Prohibiting application during bloom expected to reduce both acute and some chronic risk
- Bee hazard advisory language ("bee box")
  - On all outdoor foliar/spray applications except for non-ag turf/lawns and perimeter sprays around structures.

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Proposed Mitigation Changes

- Deliberative Process / Ex. 5

Poultry Litter

Mitigation Measure – Limit number of whole house applications for imidacloprid, clothianidin, and thiamethoxam

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Risk Mitigation – Bees (Ornamental and Turf uses)

Risk

- Strongest evidence of risk for ornamentals and forestry (moderate evidence for turf)
- Incidents of bee kills recorded for imidacloprid, clothianidin, and dinotefuran
- Uncertainty considerations:
  - Very limited data set for a diverse set of plants
  - Residues exceeded colony-level endpoints through final measurements; EFED unable to derive a safe pre-bloom interval

Residential Ornamental Mitigation: Deliberative Process / Ex. 5

Deliberative Process / Ex. 5

Production/Commercial Ornamental Mitigation: Deliberative Process / Ex. 5

Deliberative Process / Ex. 5

Turf Mitigation: Deliberative Process / Ex. 5

Deliberative Process / Ex. 5

Deliberative Process / Ex. 5

Risk Mitigation – Birds and Mammals

Seed Treatment

Risks

- For small-medium size birds and mammals, expected risk of concern with as little as 2-10% of diet
- Certain seeds are too big for small/medium sized passerine birds to ingest; some are pelleted
- Timing and duration of exposure to treated seeds at planting may limit the likelihood of exposure

Benefits

- Simple, effective control of soil pests and early-season above-ground pests
- Chlorpyrifos is likely other seed treatment but controls soil pests only
- Requiring (increased) pelleting would require machinery changes, could interfere with seed germination

Stakeholder Outreach

- Reached out to registrants and related stakeholders such as ASTA. EPA noted risk exceedances and available benefits information, and invited registrants to provide additional information or potential mitigation suggestions.

Brainstorming of Mitigation Strategy

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Proposed Risk Mitigation

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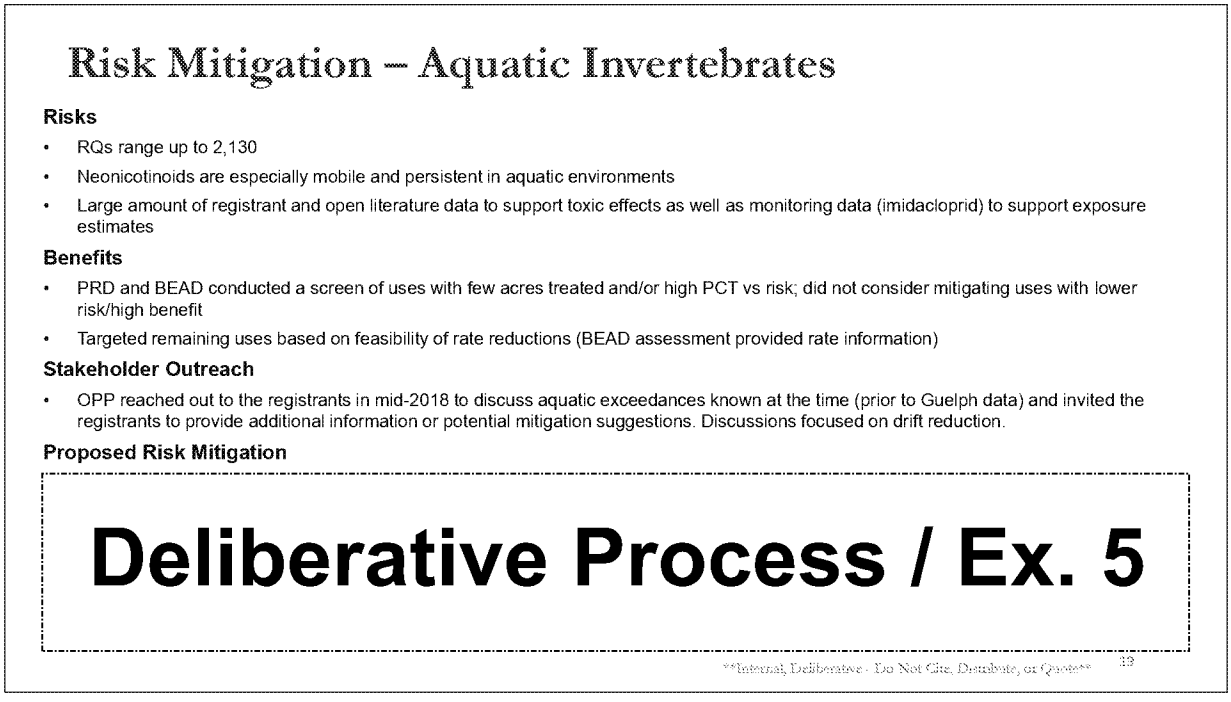
Deliberative Process / Ex. 5



We have a large amount of data available for the neonics to support potential risk exceedances to aquatic invertebrates, more data than is typically available through registration review. This data shows that neonics are specifically mobile and persistent in aquatic environments and includes not only registrant and open literature data to support toxic effects, but also monitoring data for imidacloprid to support exposure estimates.

Other considerations:
Based on representative test species, considering how these effects extend across aquatic communities + extent of risk concerns
Certain uses allow for high application rates
Risks dependent on rainfall/irrigation runoff

Risk Mitigation – Aquatic Invertebrates

Proposed Risk Mitigation (continued)

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Spray Drift Mitigation for all outdoor uses

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Runoff Mitigation for all outdoor agricultural uses

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Good labelling practices and label clarification

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Deliberative Process / Ex. 5

Human Health Risk Summary

	Dietary Exposure	Residential Exposure	Aggregate Exposure	Occupational Exposure
Imidacloprid	none	Turf – post-application	Turf – post-application	Handler risks for multiple scenarios – seed treatment
Clothianidin	none	none	none	Handler risks for seed treatment and aerosol (commercial bedbug) uses
Thiamethoxam	none	none	none	Handler risks for multiple scenarios – seed treatment
Dinotefuran	none	none	none	none

Risk Mitigation – Human Health

Residential Risk – Imidacloprid Residential & Aggregate Risks of Concern

- Proposed Turf Mitigation: Deliberative Process / Ex. 5

Deliberative Process / Ex. 5

- Previous risks of concern identified for pet collar uses
  - Comments and data received during comments to preliminary assessment changed the Agency's risk conclusions; no longer a risk of concern

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Risk Mitigation – Human Health

Seed Treatment (Occupational Risk)

- Additional PPE

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Liquid Spray Application (Occupational Risk) – Additional PPE

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Deliberative Process / Ex. 5

Neonicotinoid Stewardship

US EPA Stewardship Efforts

- Describes education and outreach programs for the care of spilled or uncovered treated seed
- Describes certain best management practices (BMPs) and technologies available to reduce dust off from application of treated seed
- Describes importance of efforts directed at improving bee health, including planting habitat, IPM for common bee pests, along BMPs and Manager Pollinator Protection Plans (MP3) to reduce exposure to bees from pesticides

Registrant Stewardship Proposal

- EPA reached out to the neonic technical registrants to develop a voluntary neonic stewardship program. The registrants proposed a plan to work together to improve and expand existing stewardship efforts
- Includes registrant out-reach to growers to identify applicable BMPs; and,
- Promotes consistency and collaboration, and utilizing their wide network of partners to amplify their existing stewardship efforts.

Other Regulatory Considerations

Seed Dust-Off

- Incidents and some field measurements indicate potential for high risk to bees in certain scenarios (corn seed planting)

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Petitions

- Currently 2 petitions related to neonicotinoids pending outcome of these decisions
  - Clothianidin risk to pollinators
  - Seed Treatment; exemption for treated seed

Note:
The majority of neonic usage is on seed treatments (for corn)

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Potential Section-18 Impact

The following are pending Section-18 requests that could be impacted by the registration review mitigation decisions:

- **Dinotefuran on Stone Fruit and Pome Fruit –**
  - IR-4 has generated residue data to support these uses but has not submitted a tolerance petition
    - EPA not considering new outdoor neonicotinoid uses while registration review is ongoing
  - EPA not currently taking any action for registered uses of dinotefuran and Section-18 uses while registration review ongoing
- **Dinotefuran on Kiwifruit –**
  - No tolerance petition pending with the Agency for a Section-3 registration for this use
- **Thiamethoxam on Rice –**
  - Syngenta has a Section-3 registration pending with the Agency for this use
- **Clothianidin on Citrus –**
  - Valent expects IR-4 to submit the tolerance petition to support Section-3 registration after registration review is completed

- **Pending Registration Actions**

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Stakeholder Interest and Outreach

Stakeholder Interest

- **Registrants –** path forward for new uses as well as a level playing field
- **Growers –** continued availability of reasonably priced and safe tools for combating insect pest pressure
- **Non-Governmental Organizations/Public –** reduction in risk/exposure to bees
- **Beekeepers –** concerns with growers utilizing pesticides that are potentially impactful to bee populations
- **Federal Regulatory Partners –** targeted mitigation to reduce potential risk exceedances in accordance with current statutory requirements that does not unreasonably impact growers
- **State Regulatory Partners –** California will be looking closely into what mitigation EPA proposes which may effect the path forward they take in their own regulatory requirements, while other state department of Ag may be concerned with potential impact to prominent grower groups in their state.

Stakeholder Outreach

- PRD recently reached out to registrants and others (e.g., USDA, CDPR) to discuss initial scoping of mitigation
- PRD plans to continue outreach to stakeholders
  - Goals
    - Anticipate impacts of proposed mitigation [briefly described above]
    - Improve how implementable and enforceable mitigation may be
  - Stakeholders
    - USDA, OPMP and IR-4
    - Growers
    - Registrants
    - States (SFIREG, AAPCO, NASDA)
    - Beekeepers
    - The public
    - Other Stakeholders (American Hort, NALP, NPMA)

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Next Steps and Timeline

Anticipated Timelines for Completion

Activity	Date
Brief to OPP	August 2019
Brief to OCSPP	September 2019
Draft Documents ready for DD review & signature	November 2019
Publication in FR and regulations.gov	Before the end of 2019

Planned Communications Materials for PID release:

- Higher level comms
- Desk statement
- OPP Update
- Website Update
- Q & A

Questions?

Back Pocket Slides

Tiered Approach for Bee Assessments

- Tier 1 analysis
  - BeeREX for on-field default and refined exposures
  - AgDrift for off-field exposures

- Tier 2 analysis
  - Nectar equivalents method to combine residues in pollen and nectar (replaces "bee bread" method)
  - Residue bridging strategy to estimate exposure from untested crops
  - Strength of evidence based on evaluation of multiple lines of evidence

New Tier 2 Exposure Methodology – Residue Bridging Strategy

- Extremely broad neonicotinoid use pattern necessitated extrapolation of bee-relevant residue data to address gaps and limitations in data
- Relied on a data-driven bridging strategy from over 80 bee-relevant residue studies to extrapolate residues, when necessary, across:
  - Chemicals, application rates, crops, matrices, time, sites
- Improved consistency in how residue data are applied to bee risk assessment
- Incorporated residue data for non-agricultural uses
- Detailed residue bridging strategy documents provided as Attachments to the Final Bee RAs
  - 1 – soil and foliar applications; 2 – seed treatment applications; 3 – non-ag applications

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The goals of the bridging strategy were to 1) develop methods to reduce uncertainties in the existing database due to lack of data or various data limitations; 2) improve how residues are applied to bee risk assessments by attempting to harmonize the methodology, where sufficient data were available, with those employed for other taxa or by other regulatory bodies; 3) and finally, to develop an approach for non-ag uses.

Distinct approaches were developed for seed treatments vs foliar/soil applications.

Residue Bridging Strategy Conclusions

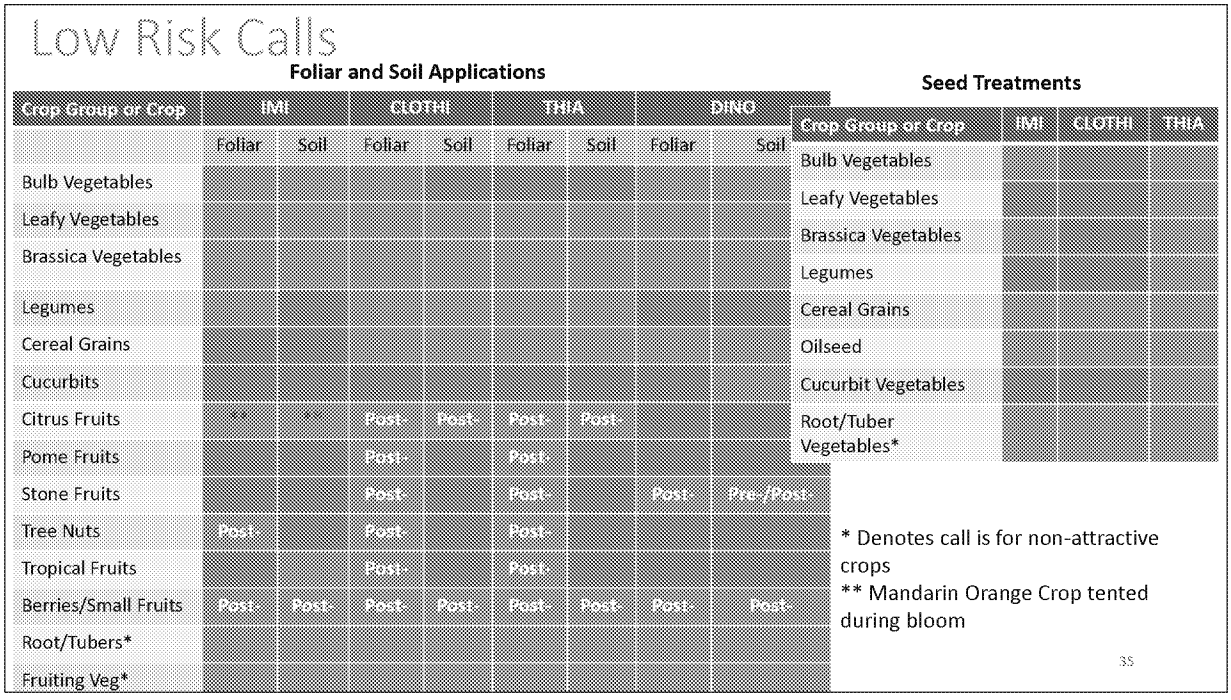
- Residues from foliar applications > soil applications > seed treatments
- Faster decline after foliar application vs. soil application
- Pre-bloom applications result in residues that are generally much higher than post-bloom applications
- Data supported extrapolation of residues among neonics, but not among application methods
- Within an application method and crop group, residues extrapolated among crops
- In absence of data for a given crop group, considered all data within an application category (e.g., tree crops, herbaceous crops)

Strength of Evidence

- Strong Evidence of Risk
  - Residues exceed colony-level endpoint(s) by a high magnitude, frequency, and/or duration
  - Chemical-specific or robust bridged residue data set available
  - Residues exceed across multiple locations
  - May be supported by modeled (*e.g.*, Monte Carlo) exposures or ecological incidents

- Moderate Evidence of Risk
  - Residues exceed colony-level endpoint(s) but magnitude, frequency, and/or duration are limited
  - Residues exceed across few locations
  - Maybe supported by limited ecological incident information

- Weak Evidence of Risk
  - Residues exceed colony-level endpoint(s) but there are uncertainties in the surrogacy in the bridged residue data set
  - Majority of residues below toxicity endpoint
  - Residues exceed at one location
  - Not supported by ecological incidents



This table summarizes the low risk calls for foliar and soil applications, represented by green cells. The gray cells indicate either the chemical is not registered for a particular use or there was a risk call (we'll get to those soon). For orchards and berries and small fruits, risk calls are distinguished for pre-bloom vs. post-bloom applications, which was a recommendation from the residue bridging strategy.

Summary of Bee Risk Conclusions for Soil Applications

Crop Group or Crop	Imidacloprid		Clothianidin		Thiamethoxam		Dinotefuran	
Cotton	Moderate							
Cucurbit Vegetables	Moderate		Moderate		Moderate			
Citrus Fruits	Pre-foliar	Post-foliar	Pre-	Post-Moderate	Pre-foliar	Post-foliar		
Pome Fruits	Pre-	Post-Weak						
Stone Fruits	Pre-	Post-Moderate					Pre-Moderate	Post-
Tree Nuts	Pre-	Post-Moderate						
Tropical Fruits	Pre-	Post-Weak						
Berries/Small Fruits	Pre-foliar	Post-	Pre-	Post-	Pre-foliar	Post-	Pre-Moderate	Post-
Root/Tubers Vegetables*	Moderate		Moderate		Moderate		Moderate	
Fruiting Vegetables*	Moderate				Moderate		Moderate	
Herbs/Spices	Moderate							

* denotes call is for honeybee attractive crops within the crop group

Here is the table summarizing risk conclusions for soil applications. Where the foliar applications are mostly strong evidence of risk, the soil applications are more moderate and weak evidence. This is because, residues from soil applications tend to be lower than foliar applications but they may persist for much longer.

New Data Set – Guelph (Raby *et al.*) Aquatic Invert Toxicity Data

- Large acute and chronic datasets across all 4 neonics (and acetamiprid)
- Acute data published Jan 2018; chronic data published July 2018
- Allowed for apples-to-apples comparison of toxicity data across the 4 neonics, accounting for lab and study conduct variability
- 22 species tested for acute, including a range of species' sensitivities and 2 most sensitive acute species tested for chronic
- Tested species did not include the most sensitive species identified for imidacloprid

Guelph Aquatic Invert Comparative Risk Conclusions

- Acute Toxicity
  - Imidacloprid similar to Clothianidin and Dinotefuran > Thiamethoxam
- Chronic Toxicity
  - Imidacloprid and Clothianidin > Dinotefuran > Thiamethoxam
- Acute and Chronic Risks
  - Comparison of risk incorporates varying chemical-specific application rates and aquatic modeling parameters
  - Imidacloprid, Clothianidin, and Dinotefuran have similar risk profiles (RQs within 10x)
  - Thiamethoxam presents lower risks